

**Operating instruction
for
Electromagnetic Flowmeter**

Model: DMI



1. Note

These instructions are to be read before unpacking and operating the device and are to be closely heeded at all times.

The devices are only to be used, maintained and serviced by persons familiar with these operating instructions and with the prevailing regulation applying to procedural safety and the prevention of accidents.

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3. Specific Application

The DMI is to be installed only in the specified applications. Every usage which exceeds the specifications is considered to be non-specified. Any damages resulting therefrom are not the responsibility of the manufacturer. The user assumes all risk for such usage. The application specifications include the installation, start-up and service requirements specified by the manufacturer.

4. Operating Principles

The flowrates of liquids with a conductivity of at least 50 $\mu\text{S}/\text{cm}$ can be measured with this flowmeter (Miniflow).

Faraday's Laws of Induction state that a voltage is generated which is proportional to the average flow velocity. This signal voltage is measured at two electrodes which are in contact with the fluid.

Various signals are available at the outputs of the converter for further processing (e.g. flowrate proportional pulses, 20 mA current output, min./max. contact output for process monitoring).

The electrical connections are made with a plug.

5. Instrument Inspection

These devices are checked before despatch and sent away in perfect condition. Should the damage to a device be visible, we recommend a thorough inspection of the delivery packing. In case of damage, please inform your parcel service/forwarding agent immediately, since they are responsible for damages during transit.

Scope of delivery:

- Magnetic Inductive Flowmeter
- Service manual

6. Mechanical connection

The DMI incorporates a threaded process connection. The diameter difference of the transition from the pipeline to the flowmeter should be kept to a minimum.

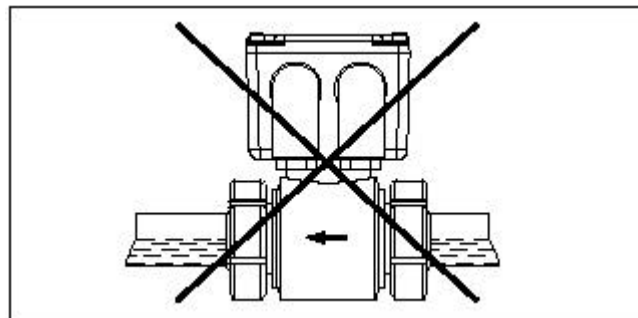
For this reason additional threaded adapters, are mounted on the flowmeter and shipped together (exceptions: flowmeter size 3/8" / DN10 and flowmeters with NPT threads).

These adapters provide the ability to install the flowmeter using a coupling union either in plastic pipelines (using the threaded adapter) or to install it in copper or other metal pipelines (by re-moving the threaded adapter and connecting directly to the threads on the flowmeter).

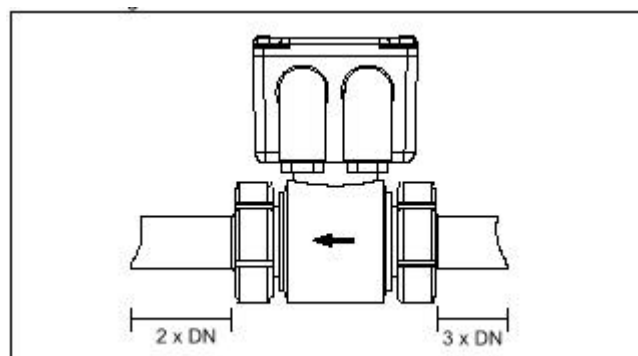
See the following Table for an overview.

6.1. Installation and start-up

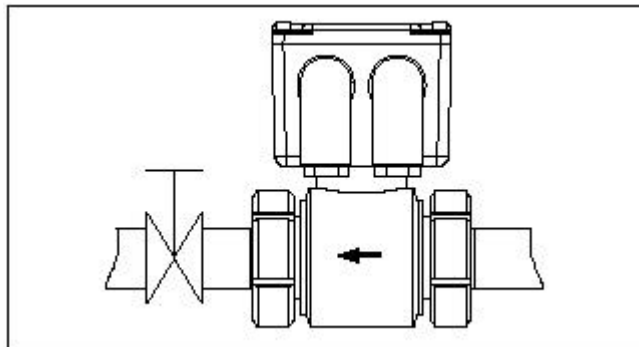
The DMI should not be installed in the vicinity of strong electromagnetic fields. The installation orientation is arbitrary! It is essential that the flowmeter always be completely filled with fluid. Partial filling results in measurement errors.



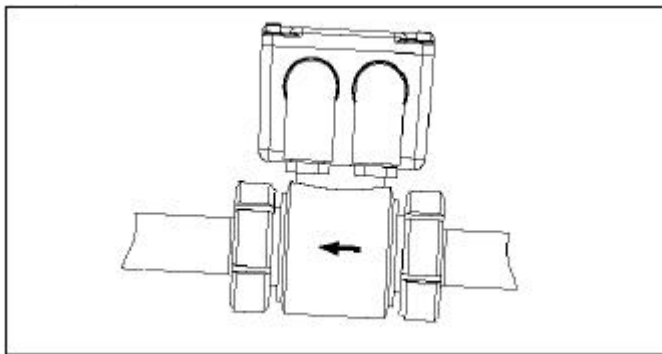
The DMI measures in both flow directions. The forward flow direction is shown by the arrow on the meter primary. If DMI should measure only in one flow direction, a straight pipe section of 3 x DN upstream and 2 x DN downstream is required. If DMI should measure in both flow directions, 3 x DN straight pipe section upstream and downstream is required.



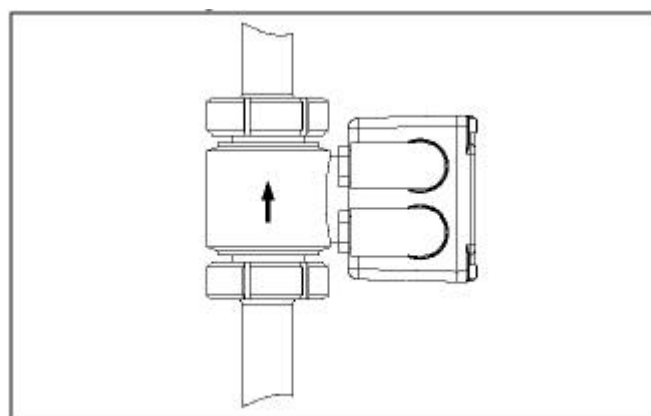
Valves or other shutoff devices should be installed downstream from the flowmeter so that it cannot drain.



A slight slope in the pipeline of approx. 3 % is advantageous in eliminating gas pockets in the flowmeter.

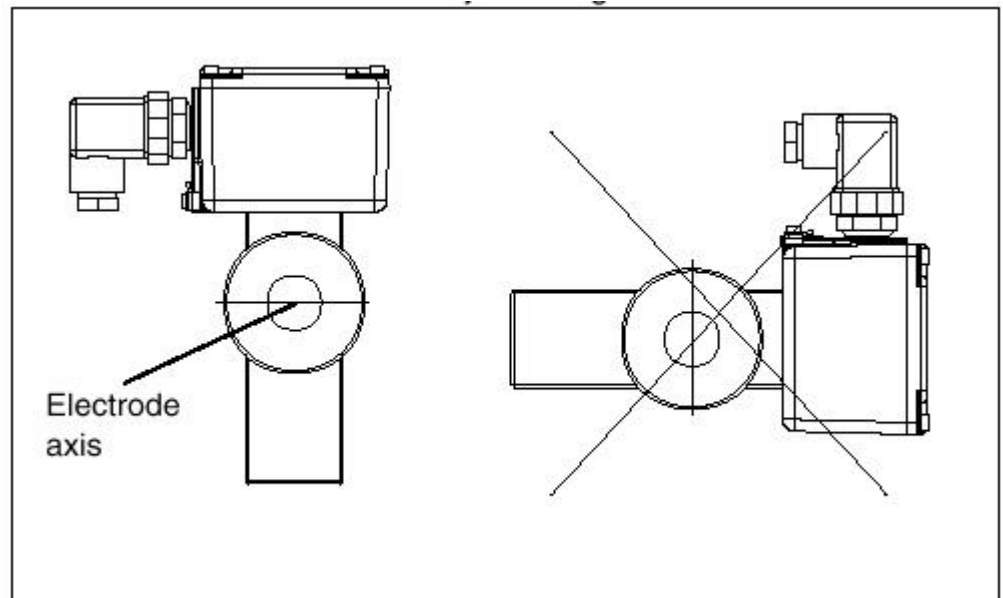


Installations in vertical pipelines are ideal when the fluid flows up. Installation in drop lines, i.e. the fluid flows from the top to the bottom should be avoided because it is impossible to assure the flowmeter will remain full due to an equilibrium condition which may exist between the downward flowing fluid and gas being forced upward.

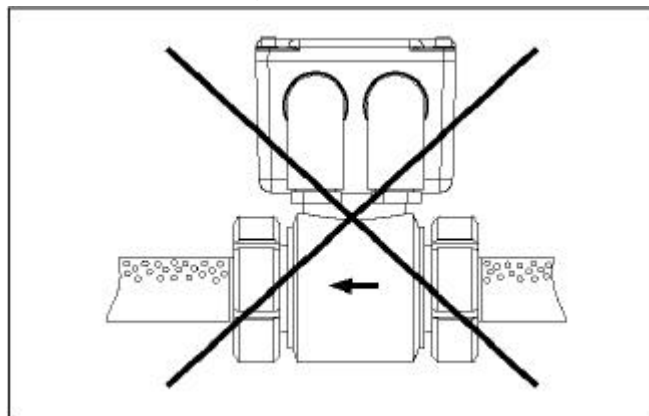


In general the flowmeter should be installed in the pipeline with the PG-Connectors facing down.

When installed in a horizontal pipeline the imaginary line between the two electrodes should be horizontal if at all possible to prevent air or gas bubbles from interfering with the flow signal which is measured at the electrodes. The position of the electrode axis is shown in the adjacent figures.



Entrained gas bubbles carried along with the fluid cause flow measurement errors.



When installed in free discharge lines the flowmeter should not be located in the high point in the pipeline or at the outlet end of the pipeline (flowmeter drains, gas bubbles).

Standing eddies (after partially open valves or when there are tangential inflows upstream of the flowmeter) which persist into the flowmeter should be avoided.

If a pump is used to produce the flow the flowmeter should be

installed on the pressure side of the pump.

In mixing systems, the flowmeter should be installed in a location where the complete mixing has taken place. Non-homogeneous fluid conditions in the flowmeter are to be avoided.

Pulsation dampers should be utilized where required.

The ground connection between the two plugs on the converter housing is to be connected to a good ground.

There are grounding electrodes integrated in the meter tube in the flowmeter.

The meter tube and the electrodes integrated in the meter tube come in contact with the fluid. Check before start-up that the materials used are chemically resistant to the fluid being measured. Gaskets should be used when installing the flowmeter.

These should also be compatible with the fluid being metered.

Assure that the maximum temperature will not exceed the following values:

- a) For meter tubes made of PEEK max. 110 °C
- b) For meter tubes made of PETP max. 60 °C

The meter tube material is listed on the Instrument Tag on the flowmeter.

Observe the max. torque values when tightening the connectors on the DMI

Torque Specifications for process connection

DN [mm]	on PEEK	on PETP
10	20 Nm	13 Nm
15	21 Nm	14 Nm
25	25 Nm	16 Nm
50	51 Nm	34 Nm

Avoid usage of ferromagnetic process connectors.

Information for using the threaded Adapters**a) Flowmeter is installed in a plastic pipeline.**

DN	Suitable for plastic pipelines with Ø-outside	Threaded Connection at Miniflow for Plastic Pipelines
10	16 mm	G 3/4 (no threaded adapter)
15	20 mm	G 1 (with threaded adapter G ³ / ₄ -G1)
25	32 mm	G1½ (with threaded adapter G1¼-G1½)
50	63 mm	G2¾ (with threaded adapter G2½-G2¾)

Example:

The DMI is to be installed in a plastic pipeline with a 20 mm outside diameter.

The above table indicates that a 1/2" / DN 15 meter size is required. The adapter shipped with the flowmeter must be used. This increased the G ¾" thread on the flowmeter to G 1" so that the coupling union, which has a G 1" thread size for size plastic pipeline, can be connected to the flowmeter.

b) Flowmeter is installed in a metal (e.g. copper) pipeline

DN	Suitable for plastic pipelines with Ø-outside	Threaded Connection at DMI for Metal pipeline
10	14 mm = ½" tubing	G 3/4 (no threaded adapter)
15	18 mm = ¾" tubing	G 3/4 (no threaded adapter)
25	28 mm = 1" tubing	G1¼ (no threaded adapter)
50	54 mm = 2" tubing	G2½ (no threaded adapter)

Example:

The DMI is to be installed in a metal pipeline with a 14 mm outside diameter, i.e. ½" metal tubing.

The above table indicates that a 3/8" / DN 10 meter size is required. The adapter shipped with the flowmeter must be removed since it is only required for installations in plastic pipelines. With the threaded adapter removed the 3/8" / DN 10 flowmeter size has a G ¾" threaded connection. This is the connection size required for the G ¾" coupling union used with the ½" metal tubing.

7. Electrical connection

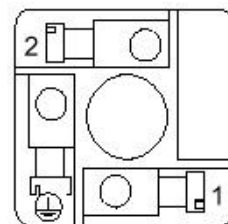
7.1. Signal Outputs and supply power

Wiring

Standard DIN 43650 plug connector with PG 9-cable glands, pipe cross section max. 1,5mm², IP 65 rating. Open plug and wire according following instructions:

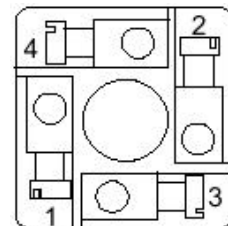
Three-PIN-Plug = Supply power

- 1 24 V AC/DC
- 2 GND
- ⊕ Ground



Four-PIN-Plug = Signal Outputs

Pin 1+2 20 mA or contact input (option)
 Pin 3+4 Pulse / contact output (option)
 (Also see Section „Interconnections, Peripherals“)

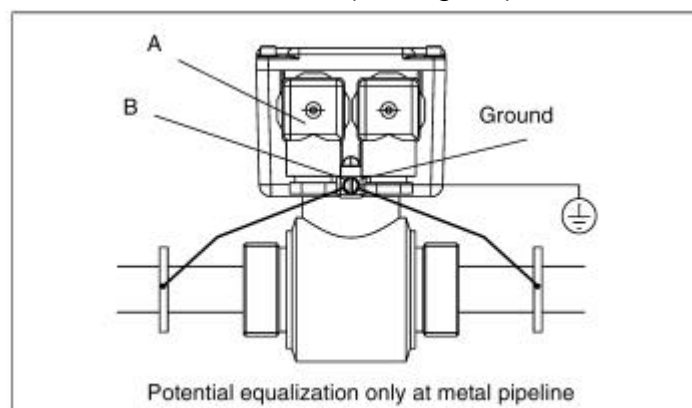


7.2. Grounding

When installing the flowmeter in a metal to the plug (Point A) together with the supply power (left plug), then the connection at Point B must be at the same potential as at Point A.

Attention

If a ground connection is made to the plug (Point A) together with the supply power (left plug), then the connection at Point B must be at the same potential as at Point A. If this cannot be assured then the ground should be connected at only one point – either in the plug (Point A) or externally to the flowmeter (Point B). It is recommended that a ground be connected to Point B. (See fig. 11)

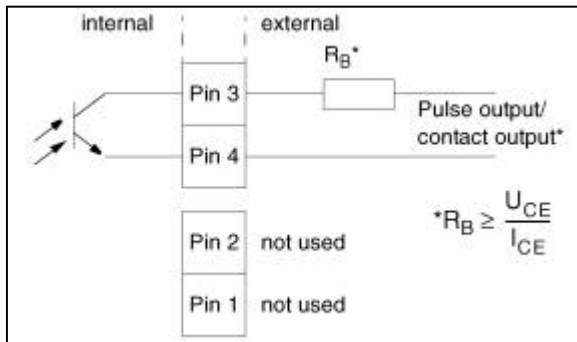


7.3. Interconnection Diagram

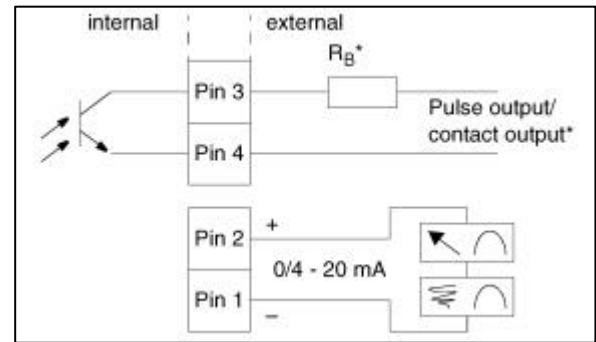
Interconnection Examples for Peripherals

Option: ...A..

Pulse output, passive,
optocoupler or
contact output passive, optocoupler

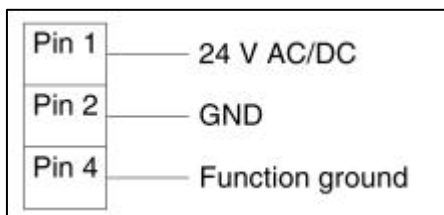


Pulse output, optocoupler
and current output 0/4 – 20 mA or
contact output, passive,
optocoupler and current output 0/4-
20 mA)



Option: ...B..

Power supply: 24 V AC/DC



Signal Output Specifications

* The function assigned to the optocoupler of the signal output can be set in the software. Function either as a pulse output or function as a contact output.

Pulse output passive

(Optocoupler specifications:)

$16 \text{ V} \leq U_{CEH} \leq 30 \text{ V}$; $0 \text{ V} \leq U_{CEL} \leq 2 \text{ V}$;

$0 \text{ mA} \leq I_{CEH} \leq 0,2 \text{ mA}$; $2 \text{ mA} \leq I_{CEL} \leq 220 \text{ mA}$

$f_{max} = 20 \text{ pulse/sec}$; pulse with 20 ms

or

Contact output passive, Optocoupler

The selection can only be made in the options with a display. In the „contact output mode“ one of the following signals can be set:

Current output: selectable 0/4 to 20 mA; Burdon $\leq 600 \text{ Ohm}$

Power supply: 16,8...26,4 VAC bzw. 16,8...31, 2 VDC

Ripple: 5 %

Power consumption: $< 5 \text{ W}$

8. Configuration

8.1. Overview of the Factory Settings in the converter

The DMI is shipped from the factory with preset values. The factory settings can be changed at the flowmeter installation site.

The following table provides an overview of the factory settings:

Factory settings

Flow range	
DN 10	50 l/min
DN 15	100 l/min
DN 25	300 l/min
DN 50	1200 l/min
Units	l/min
Current output (Option)	4 - 20 mA
Damping	5 Sec.
Pulse output	1 pulse / Liter
Pulse width	20 ms

8.2. DMI configuration

The converter can now be configured using menu structured clear text displays.

- Flow range and damping can be set in an infinite number of steps.
- Additional direct reading units can be user selected for the flowrate measurements.
- The function assigned to the optocoupler for the pulse output can be changed. (e.g. min. alarm, max. alarm etc.)

Flow Range Table

DN	Flow Range in l/min can be set anywhere between	
10	min. 0 - 2,5 l/min	max. 0 - 50 l/min
15	min. 0 - 5 l/min	max. 0 - 100 l/min
25	min. 0 - 15 l/min	max. 0 - 300 l/min
50	min. 0 - 60 l/min	max. 0 - 1200 l/min

DN	Flow Range in Usgal/min can be set anywhere between	
10	min. 0 - 1,0 gal/min	max. 0 - 10 gal/min
15	min. 0 - 1,5 gal/min	max. 0 - 25 gal/min
25	min. 0 - 4 gal/min	max. 0 - 80 gal/min

50	min. 0 - 16 gal/min	max. 0 - 320 gal/min
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Display format

The display of the DMI magmeter is a graphic display with 97*32 pixel.

Display view

The flowrate is displayed in the upper display line. The difference totalizer, which indicates forward and reverse flow as a single value, is shown in the lower display line. Alarms will be displayed in clear text.

>V	122.5
	l/min
>V	3256 l

Data entry

During data entry the converter remains on-line, the current and pulse outputs continue to indicate the instantaneous operating values. The function of the individual keys is described below:



Clear key is used to toggle back and forth between the operating mode and the menus.




Arrow keys are used to scroll forward through the menus. All desired parameters can be accessed.



The ENTER function requires that both of the arrow keys be pressed simultaneously. ENTER is used to turn the program protection on and off to change and fix new parameter values.


8.3. Data Entry instructions „Condensed Form“

Action	use keys =	Display-Information						
Starting point „Process information“		<table><tr><td>→ V</td><td>233,55</td></tr><tr><td></td><td>l/min</td></tr><tr><td>→ V</td><td>3225 l</td></tr></table>	→ V	233,55		l/min	→ V	3225 l
→ V	233,55							
	l/min							
→ V	3225 l							
Example: Flowrange setting Qmax	#	<table><tr><td colspan="2">An arbitrary parameter is displayed</td></tr></table>	An arbitrary parameter is displayed					
An arbitrary parameter is displayed								
Find Parameter "Prog. Protection"	↓	<table><tr><td colspan="2">*Program Protection"</td></tr><tr><td colspan="2">on</td></tr></table>	*Program Protection"		on			
*Program Protection"								
on								
"Program Protection"	⏏	<table><tr><td colspan="2">*Program Protection"</td></tr><tr><td colspan="2">off</td></tr></table>	*Program Protection"		off			
*Program Protection"								
off								

Direct Numeric Entry			Entry from a Table													
Action	use keys	=	Display-Inform.	Action	use keys =	Display-Inform.										
Find Parameter "Qmax"	arrow key ↓		<table><tr><td>→ V</td><td>233,55</td></tr><tr><td></td><td>l/min</td></tr><tr><td>→ V</td><td>3225 l</td></tr></table>	→ V	233,55		l/min	→ V	3225 l	Find submenu „current output“	arrow key ↓	<table><tr><td colspan="2">Submenu</td></tr><tr><td colspan="2">current output</td></tr></table>	Submenu		current output	
→ V	233,55															
	l/min															
→ V	3225 l															
Submenu																
current output																
Change Parameter "Qmax"	ENTER ⏏		<table><tr><td colspan="2">Qmax</td></tr><tr><td>-</td><td>l/min</td></tr></table>	Qmax		-	l/min	Change Parameter „current output“	ENTER ⏏	<table><tr><td colspan="2">Current output</td></tr><tr><td colspan="2">0 - 20 mA</td></tr></table>	Current output		0 - 20 mA			
Qmax																
-	l/min															
Current output																
0 - 20 mA																
Enter the desired numbers in sequence	6 x ↑	6	<table><tr><td colspan="2">Qmax</td></tr><tr><td>6 2 0</td><td>l/min</td></tr></table> 	Qmax		6 2 0	l/min	Change from 0-20 mA to 4-20 mA	ENTER ⏏	<table><tr><td colspan="2">Current output</td></tr><tr><td colspan="2">0 - 20 mA</td></tr></table>	Current output		0 - 20 mA			
	Qmax															
	6 2 0	l/min														
	Current output															
0 - 20 mA																
	↓		find desired current output	arrow key ↓	<table><tr><td colspan="2">Current output</td></tr><tr><td colspan="2">4 - 20 mA</td></tr></table>	Current output		4 - 20 mA								
Current output																
4 - 20 mA																
	2 x ↑	2	accept new current output value	ENTER ⏏	<table><tr><td colspan="2">Current output</td></tr><tr><td colspan="2">4 - 20 mA</td></tr></table>	Current output		4 - 20 mA								
Current output																
4 - 20 mA																
	↓															
accept new Qmax value	ENTER ⏏		<table><tr><td colspan="2">Qmax</td></tr><tr><td>6 2 0</td><td>l/min</td></tr></table>	Qmax		6 2 0	l/min									
Qmax																
6 2 0	l/min															

Exit from Qmax Find Parameter Prog. Protection	↓	<table><tr><td colspan="2">*Program Protection"</td></tr><tr><td colspan="2">off</td></tr></table>	*Program Protection"		off			
*Program Protection"								
off								
Turn Prog. Protection on again	⏏	<table><tr><td colspan="2">*Program Protection"</td></tr><tr><td colspan="2">on</td></tr></table>	*Program Protection"		on			
*Program Protection"								
on								
Exit point Process information Converter remains online	#	<table><tr><td>→ V</td><td>233,55</td></tr><tr><td></td><td>l/min</td></tr><tr><td>→ V</td><td>3225 l</td></tr></table>	→ V	233,55		l/min	→ V	3225 l
→ V	233,55							
	l/min							
→ V	3225 l							

8.4. Data Entry Instructions

Submenu/Parameter	Entry	Comments
<div>Prog. Protection off</div> <div>↓</div> <div> <div>Prog. Protection off</div> <div>↓</div> <div>Prog. Protection on</div> </div>	table	ON / OFF Data can only be entered after the Prog. Protection has been turned off. Exit the submenu 
<div>Language German</div> <div>↓</div> <div> <div>Language German</div> <div>↓</div> <div>Language German</div> </div>	table	German/English (Default-setting is German)
<div>Size DN 15</div>	table	DN 10, 15, 25, 50 see tag
<div>Range DN 100 l/min</div>	only for Info	Widest measuring range the meter can be set to. Automatic setting based on the flowmeter size selection.
<div>Range 60 l/min</div>	numeric	Flow range for forward and reverse flow directions. (Default-value is RangeDN) min. flow range setting 0-0.5 m/s; max. flow range setting 0-10 m/s The engineering unit is to be set in the submenu „Unit“
<div>Unit l/min</div>	table	l/s; l/min; l/h; gal/s; gal/min; gal/h (Default-value is l/min)
<div>Damping 5.0 s</div>	numeric	Range: 5 to 40 seconds. (Default-value is 5 sec.)
<div>Low flow cut off 1 %</div>	numeric	Range 0-10 % of the selected flow range end. Affects to the display indication and all outputs. The switching point for the flow cutoff incorporates a hysteresis of 0.5 %. (Default-value for low flow cutoff is 1 %)
<div>Prog. Input Ext. zero return</div>	table	External zero return or totalizer reset or without function. This submenu will only be displayed if this option was ordered. If this function is available 20 mA output will be omitted then. <u>Note:</u> If the name tag indicates a „Variant“ 5, this option is available. (Default-setting for Prog. Input is „without function“)

Submenu/Parameter	Entry Type	Comments
<div>Prog. Output pulse</div> <div> <div>↓</div> <div> <div>↓</div> <div>Prog. Output pulse</div> <div>↓</div> <div>Prog. Output F / R Signal</div> <div>↓</div> <div>Prog. Output General alarm</div> </div> </div>	<div>table</div>	<div>Selectable as pulse output or forward/reverse flow direction signal or Min.-Alarm, Max.-Alarm, Min./Max.-Alarm, General Alarm, No Function. Note: In conjunction with pulse output, internal setting are: 1 pulse per liter or per gallon, pulse width 20 ms, max. pulse frequency 20 Hz.</div> <div>Default-setting for Prog. output is „pulses“</div>
<div>Pulse 1.0 / l</div>	entry from table	Pulse weight selectable (0.1 pulse or 1 pulse or 10 pulses per litre).
<div>Pulse Width 600 ms</div>	only for info	<div>only for infor, no settings possible. Automatic setting of pulse weight based on adjusted flow range On/Off ratio 1:1 (pulse on width = off width) if pulse-width is within 2550 ms (max. pulse-width) and within 20 ms (min. pulse-width).</div> <div>If other pulse-width is required, change pulse weight or flow range. Calculation of pulse-width: $30 / (Q_{max} \times \text{pulse weight}) = \text{pulse width in seconds}$ insert Q_{max} in l/min and pulse weight in pulse/Liter in above equation.</div>
<div>MAX Alarm 105 %</div>	numeric	<div>Limit alarm, range 0-105 % of the flow range setting. An alarm will always be indicated in the display. An output signal can only be obtained if in the submenu „Prog.output“ Min. Alarm, Max. Alarm or Min./Max. Alarm was selected. (Default-value for Max.Alarm is 105 %)</div> <div>Pinning see connection diagram. Switching hystereses: 1 %</div>
<div>MIN Alarm 0 %</div>	numeric	<div>Limit alarm, range 0-105 % of the flow range setting. An alarm will always be indicated in the display. An output signal can only be obtained of in the submenu „Prog.output“ Min. Alarm, Max. Alarm or Min./Max. Alarm was selected. (Default-value for Min.Alarm is 0 %)</div> <div>Pinning see connection diagram. Switching hystereses: 1 %</div>

Submenu/Parameter	Entry Type	Comments
<div> <div>Contrast</div> <div>↓</div> <div> <div>Contrast</div> <div>↓</div> </div> </div>	<div> <div>Contrast</div> <div>↓</div> </div>	Adjust the contrast of the display by use of the arrow keys.
<div> <div>Simulation off</div> <div>↓</div> <div> <div>Simulation off</div> <div>↓</div> <div>Simulation on</div> </div> <div>DL5000 8/2000 D699G002U01 A.10</div> <div>Service-Code</div> </div>	<div> <div>Simulation off</div> <div>↓</div> </div>	<p>This features is being used to check the 20 mA loop and to check the pulse output loop. The meter will not be Online is simulation is set to on. The 20 mA signal and the pulse output will correspond to the settings done by arrow keys. If simulation is turned on the flowrate value has to be entered in % and to be fixed with ENTER. After press [#] to return to process display. The display then shows „simulation“. The Miniflow is longer online now. By pressing the error key the flowrate can now be increased or decreased. After completion of the simulation program the parameter Simulation must be turned off.</p> <p>Data of the software being used.</p> <p>For ABB Service only.</p>

9. Mechanical putting into operation

Gas pockets

It has to be accertained that the instrument is always completely filled with fluid. Partial fitting as well as gas pockets results in measurement errors.

10. Technical data

Materials

Body / lining:	PEEK or PETP
Electrodes:	Hastelloy C
Ground electrode:	Hastelloy C
Max. pressure:	10 bar (over whole temp. range)
Max operating Temperature.:	-25°C...+110°C (PEEK) -25°C...+60°C (PETP)
Ambient Temperature:	-25°C...+50°C
Conductivity:	min. 50 µS/cm
Inlet and outlet: (recommended)	3 x DN inlet 2 x DN outlet
Accuracy:	± 3% (für $Q > 0,07 \times Q_{\max}$) $\pm Q_{\max} \times 0,0021$ (für $Q \leq 0,07 \times Q_{\max}$) (Option: ± 1,5% of actual range)
Repeatability:	≤ 0,2% of actual range
Creep suppression:	adjustable 0-10 % of the adjusted range (Hysteresis 1%)
Response time:	5s (step function 0-99%) Adjustable between 5-40 Sec.
Frequency of excitation:	6¼ Hz
Protection:	IP 65, EN 60529
Vibration resistance:	15 m/s ² (max. acceleration at 10-150 Hz)
Pressure loss:	Series DMI don't have any parts loading into the measuring tube. The pressure loss disregardingly small.

Electronic

Power supply:	16,8-31,2 VDC or 16,8-26,4 VAC
Ripple:	5 %
Power consumption:	< 5 W
Display:	3 line (97 x 32 pixel)
Electr. connection:	plug in DIN 43650
Impulsausgang: fest eingestellt	1 pulse / Liter (Gallon)
Pulse width:	20 ms
Pulse frequency:	max. 20 Hz
Output signal:	0 or 4-20 mA (adjustable); Load ≤ 600 Ohm

Optocoupler

The optocoupler output can be set either as a pulse output or switch output.

a) Pulse output passive

(Optocoupler:)

Voltage:	$16\text{ V} \leq U_{\text{CEH}} \leq 30\text{ V}; 0\text{ V} \leq U_{\text{CEL}} \leq 2\text{ V};$
Current:	$0\text{ mA} \leq I_{\text{CEH}} \leq 0,2\text{ mA}; 2\text{ mA} \leq I_{\text{CEL}} \leq 220\text{ mA}$
Max. frequency:	20 pulses/sec;
Pulse width:	fixed 20 ms

or

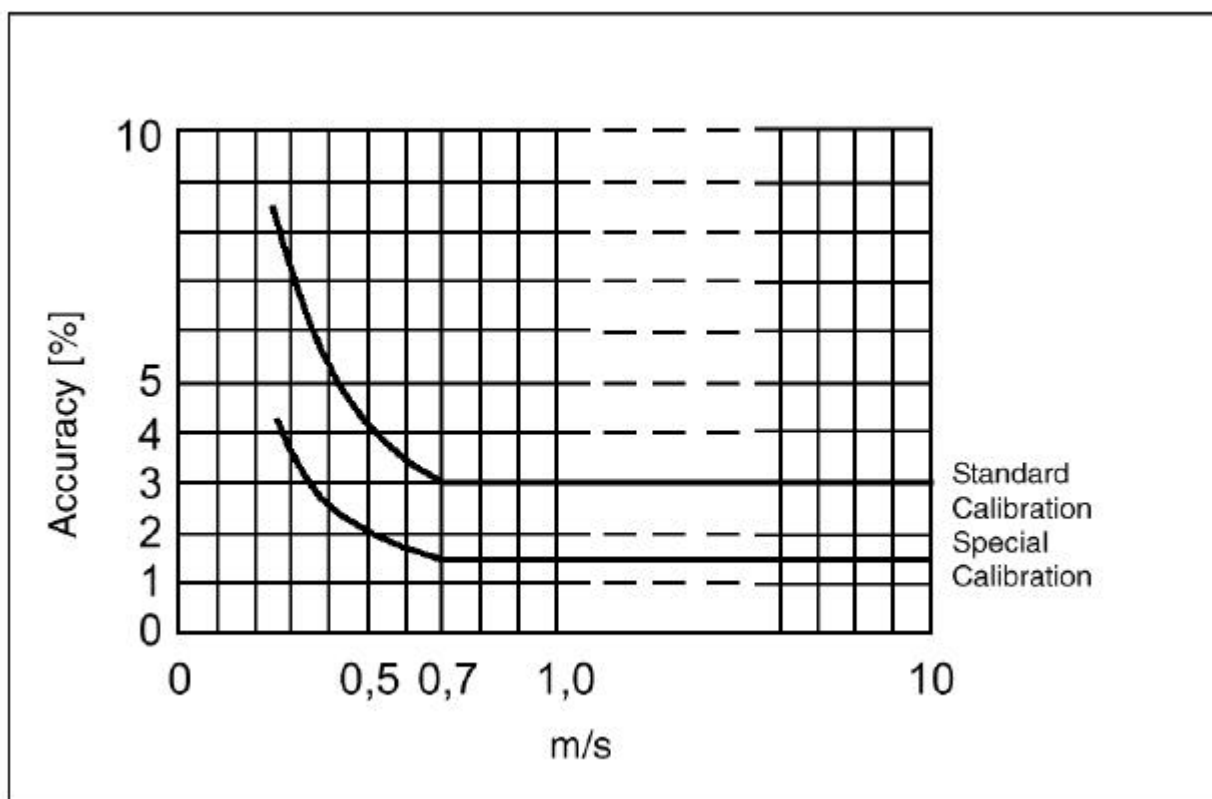
b) Switch output

Function adjustable:	Example: forward/backflow-switching, min/max contact, system alert
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Technical data optocoupler:	see pulse output
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Error signal:	The switch output (optocoupler) can be set as a system alert
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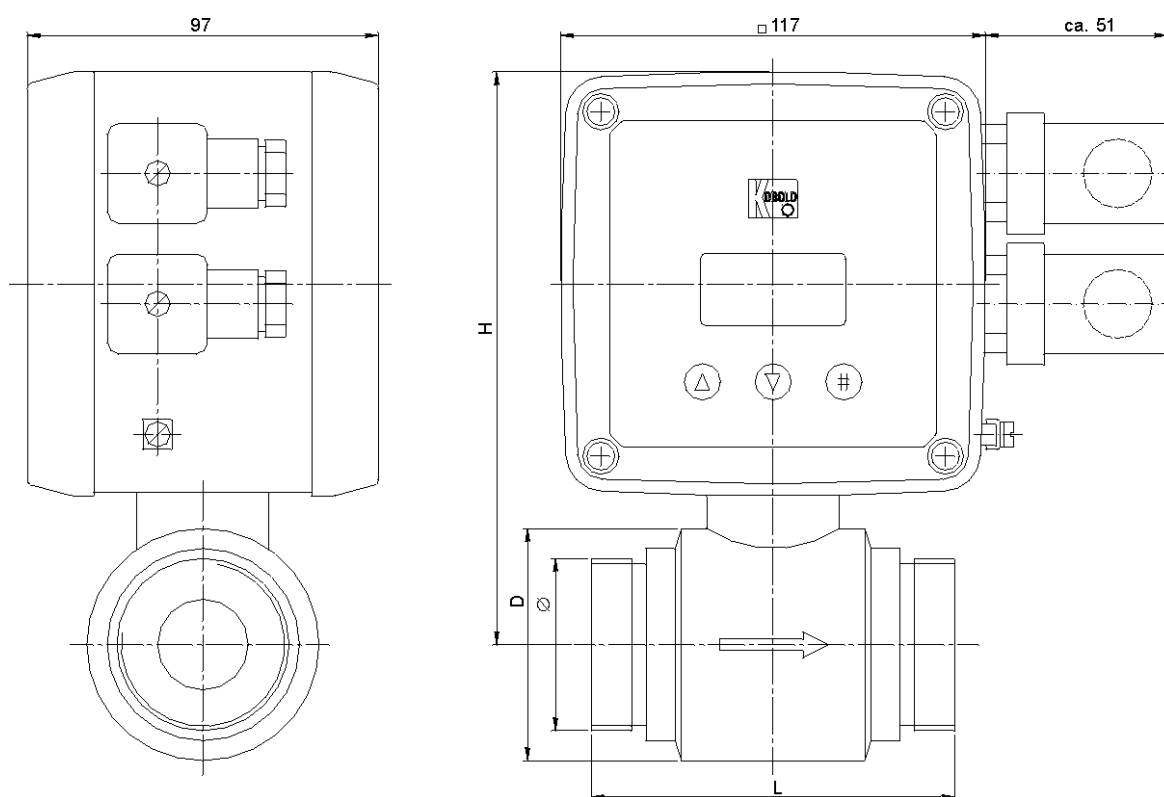
Measurment error under reference condition
(Pulse output)



For $Q_{\max DN}$ (s. shedule below)

DN	$Q_{\max DN}$
10	50 l/min
15	100 l/min
25	300 l/min
50	1200 l/min

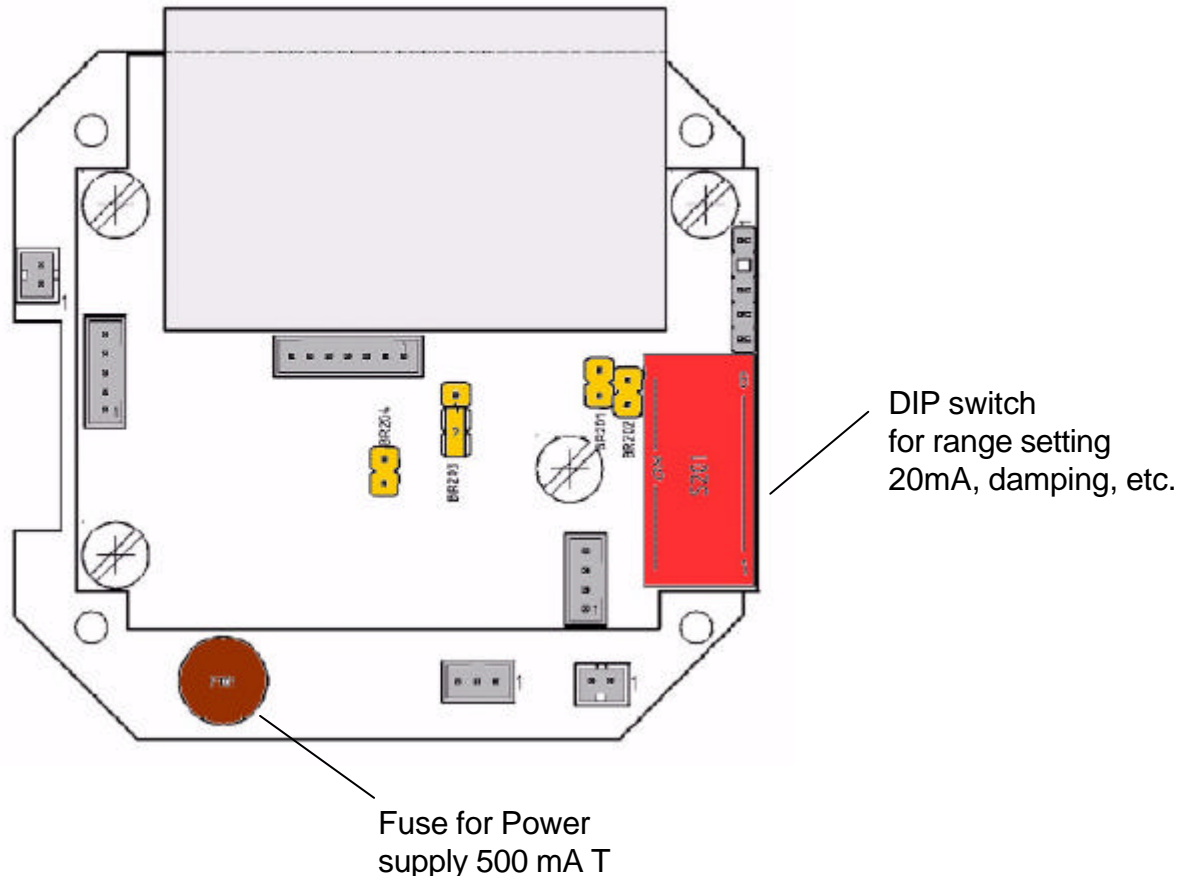
11. Dimensions



Type	L	D	Æ	H
DMI-..02	85	53	G ¾	150
DMI-..04	85	53	G ¾	150
DMI-..06	100	64	G 1 ¼	159
DMI-..08	130	92	G 2 ½	175

12. Fuse Locations

Location of fuse on the signal input PCB board



13. Declaration of conformance

We, Kobold-Messring GmbH, Hofheim-Ts., Germany, declare under our sole responsibility that the product

Electromagnetic flowmeter Type: DMI...

to which this declaration relates is in conformity with the standards noted below:

EN 50081-1	3/93
EN 50081-2	3/94
EN 50082-1	3/93
EN 50082-2	2/96

following the provision of European Directives:
89/336/EWG

Signed:



H. Peters

M. Wenzel

Datum: 10.10.00